Oregon's Consumption-Based Greenhouse Gas Emissions Inventory

Prepared for:

Connecticut Governor's Council on Climate Change - Exploring Climate Solutions Webinar Series

October 27, 2015

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Outline of today's presentation

- Background on GHG inventories
- Oregon's consumption-based emissions inventory
  - Motivation
  - Method
  - Results
  - Uses
  - Challenges
- Integration with in-boundary inventory
- Actions and next steps
- Questions and discussion

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Background

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Traditional, in-boundary inventories

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Common uses of community-scale greenhouse gas (GHG) inventories

- Establish a baseline and measure progress towards climate change goals
- Identify sources of emissions that the community can influence, identify trends in those emissions, and inform related efforts
  - Support climate related projects, programs, planning efforts
  - Provide data and tools to community partners (e.g. cities, community groups, businesses, individuals)
  - Inform development of emissions reduction policy and targets
- Communicate all of the above to policy-makers and the public

Limitations of the (modified) “snow globe”

- Provides an incomplete perspective of how communities contribute to emissions . . .
  - . . . and by extension, opportunities to reduce emissions
  - Particularly acute for materials!
- Appears to penalize local production, reward outsourcing (“leakage”)
- May lead to sub-optimal decisions (e.g., discontinue recycling)
- Alone, may provide misleading signals of change over time

Local consumption, global production

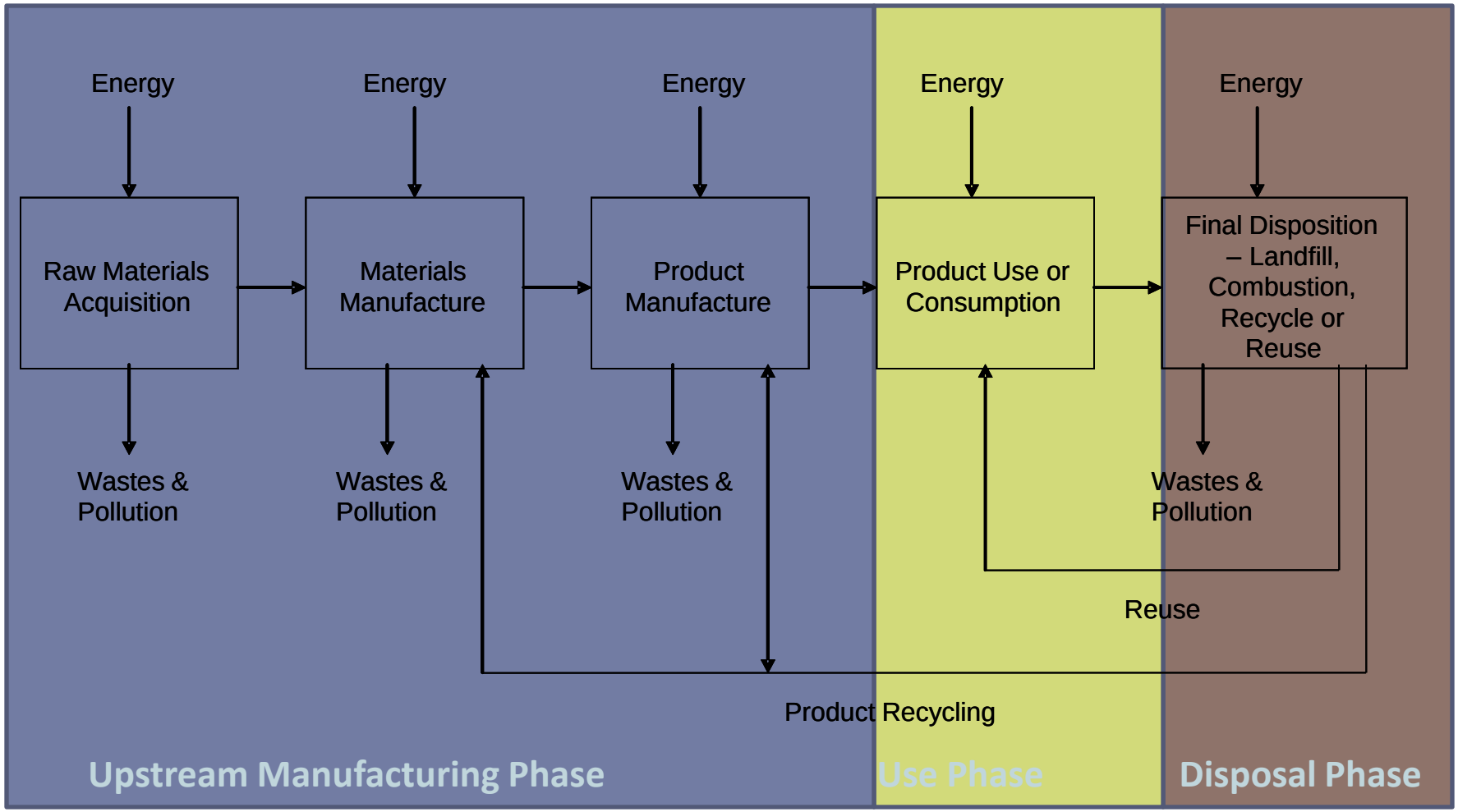
Der Spiegel, The Global Toothbrush, 01/31/2006

http://www.spiegel.de/international/spiegel/0,1518,398229,00.html

Consumption-based emissions inventories

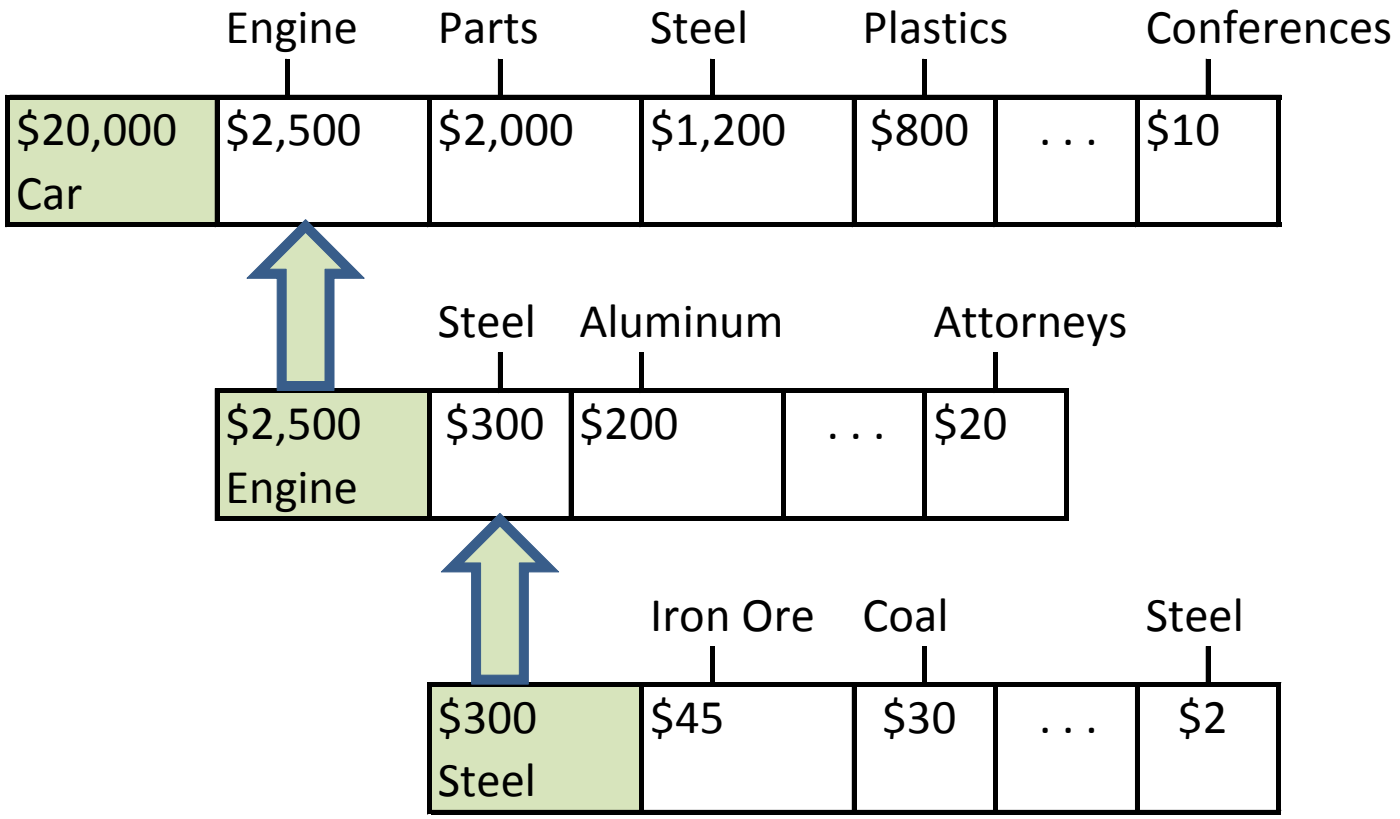
- GHG emissions resulting from *consumption*
  - "Consumption" is typically defined in economic terms (purchases by "consumers" = households, government, business capital formation)
  - Consumption = a "root driver" of emissions
  - Emissions are life-cycle emissions and globally distributed
    - "Life-cycle" = Supply chain/Production + Use + Disposal
  - Includes, but not limited to, materials
    - Includes all fuels, energy, materials and services "consumed" by the community

Method: Hybrid life cycle analysis



Based on presentation by:
Jeffrey Morris, Sound Resource Management
H. Scott Matthews, Carnegie Mellon University
Michelle Morris, Sound Resource Management
Frank Ackerman, Tufts University

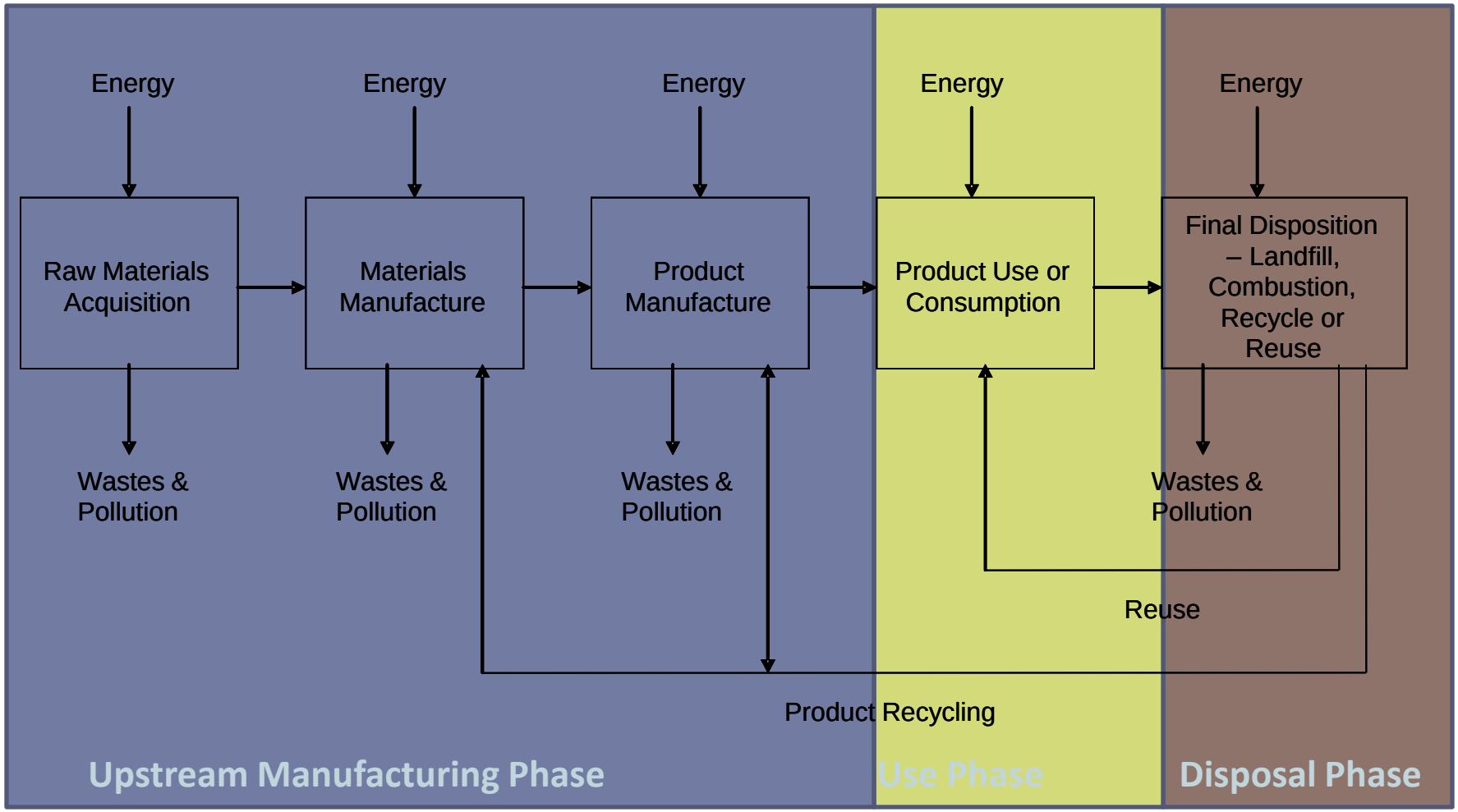
Economic input-output analysis



Economic input-output life-cycle analysis

- Economic input-output analysis estimates financial flows through the supply chain
- Input-output LCA estimates *emissions intensities* (direct emissions/dollar) for different industries
- Life cycle emissions = (dollars) x (emissions/dollar)
- Oregon's model uses 440 - 509 commodities and 3 geographic regions
  - Oregon and US economic data (consumption, trade, inter-industry multipliers, imports) from IMPLAN
  - Oregon and US emissions data from in-boundary inventories
  - Foreign emissions intensities from CICERO

Method: Hybrid life cycle analysis



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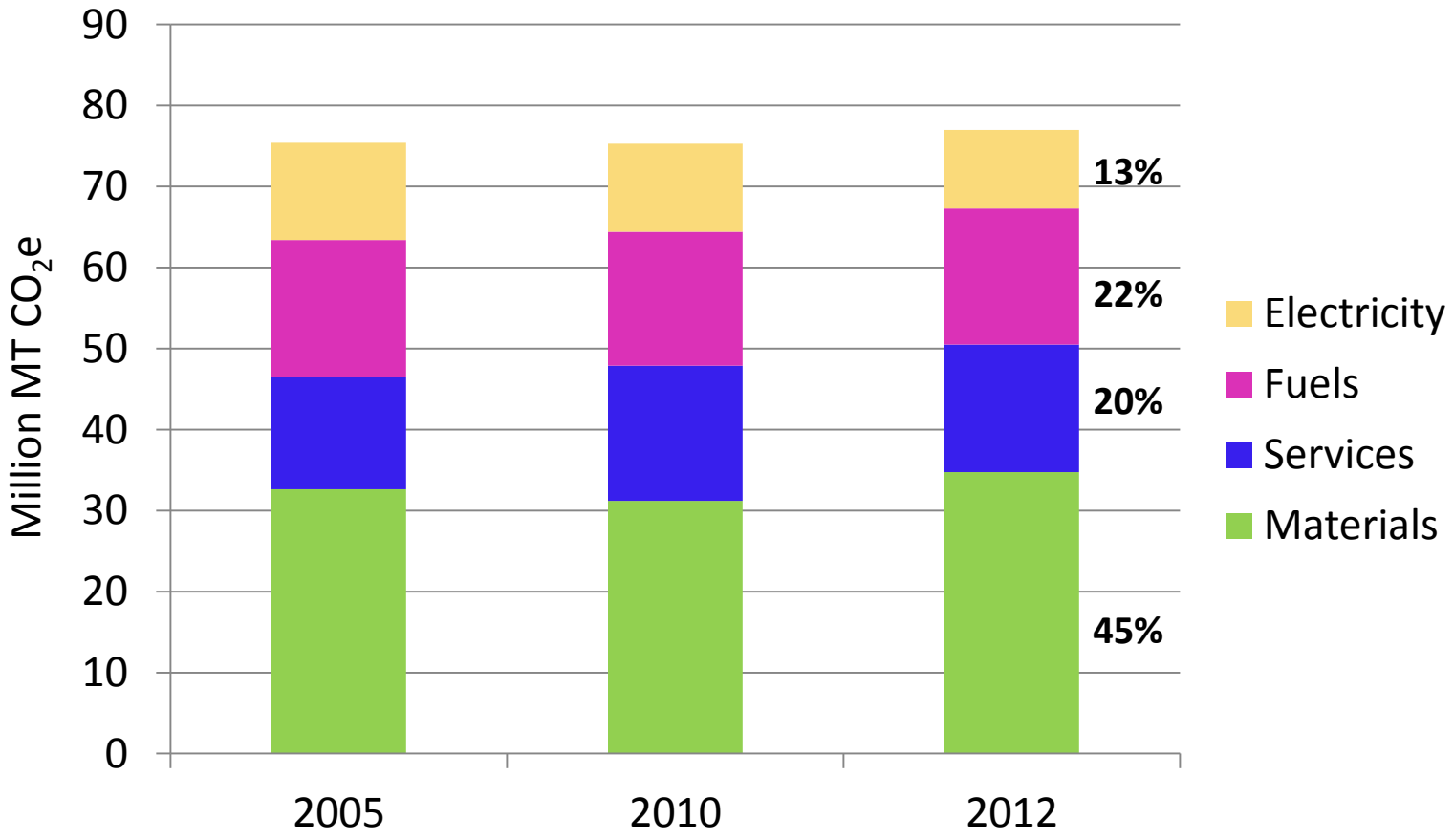
Oregon Consumption-Based Greenhouse Gas Emissions, by Type of Consumption



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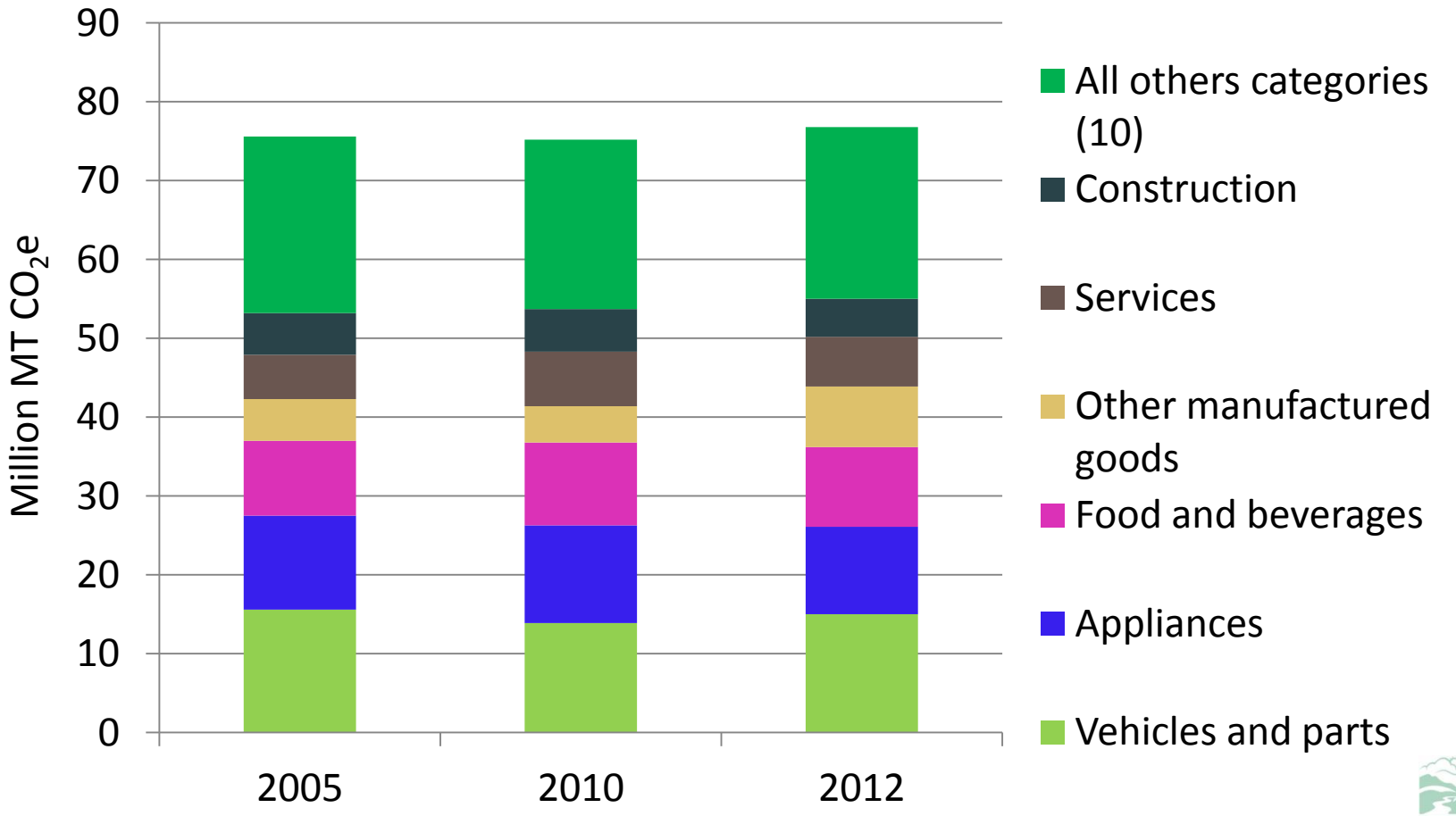
Oregon Consumption-Based Greenhouse Gas Emissions by Major Category of Consumption



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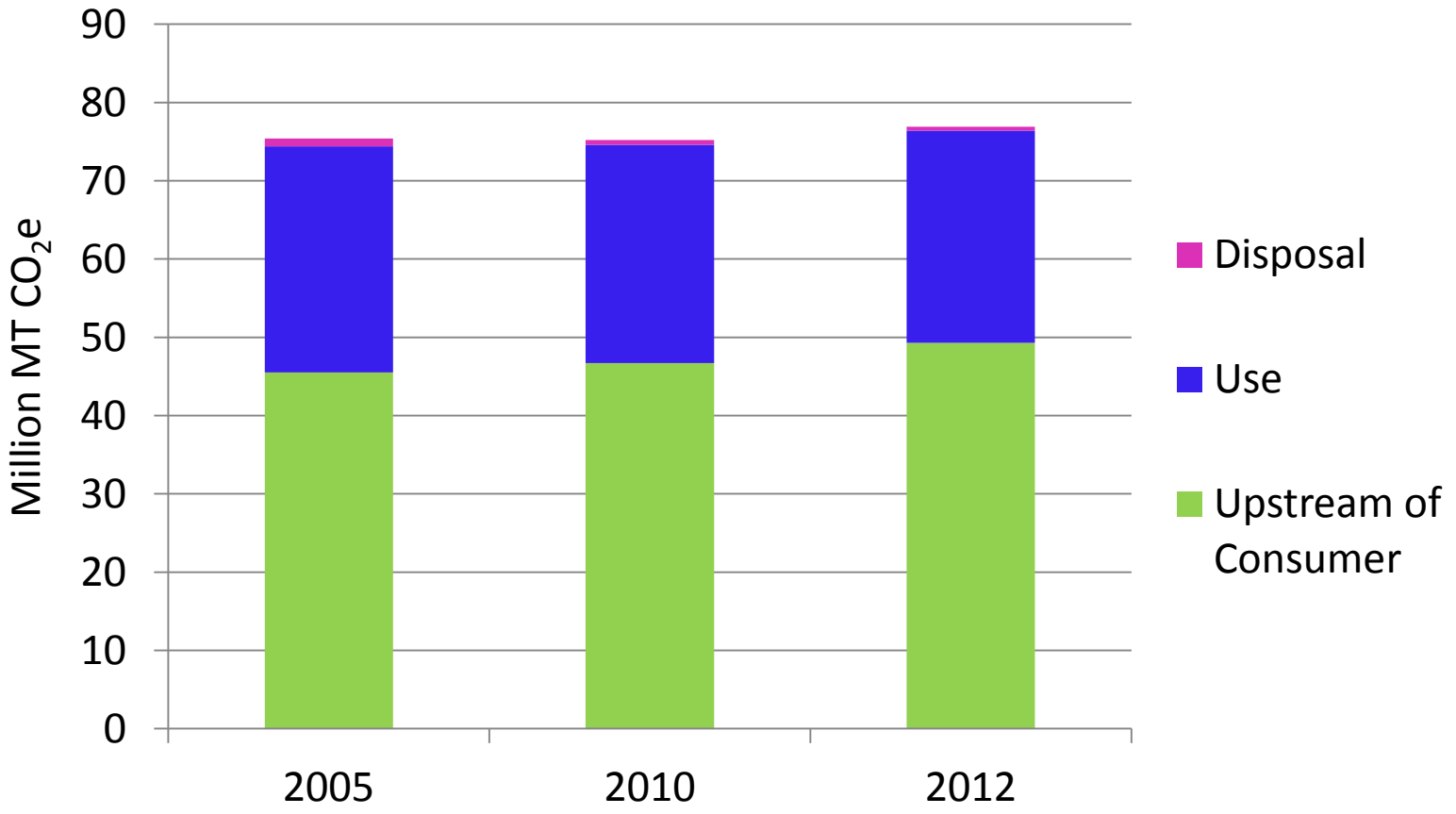
Oregon Consumption-Based Greenhouse Gas Emissions by Life-Cycle Stage



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Emissions intensities

Final Demand	Average LCA Emissions Intensities (kg CO2e/2010$)
Materials	0.5
Electricity	7.2
Fuel	3.8
Services	0.1 - 0.2

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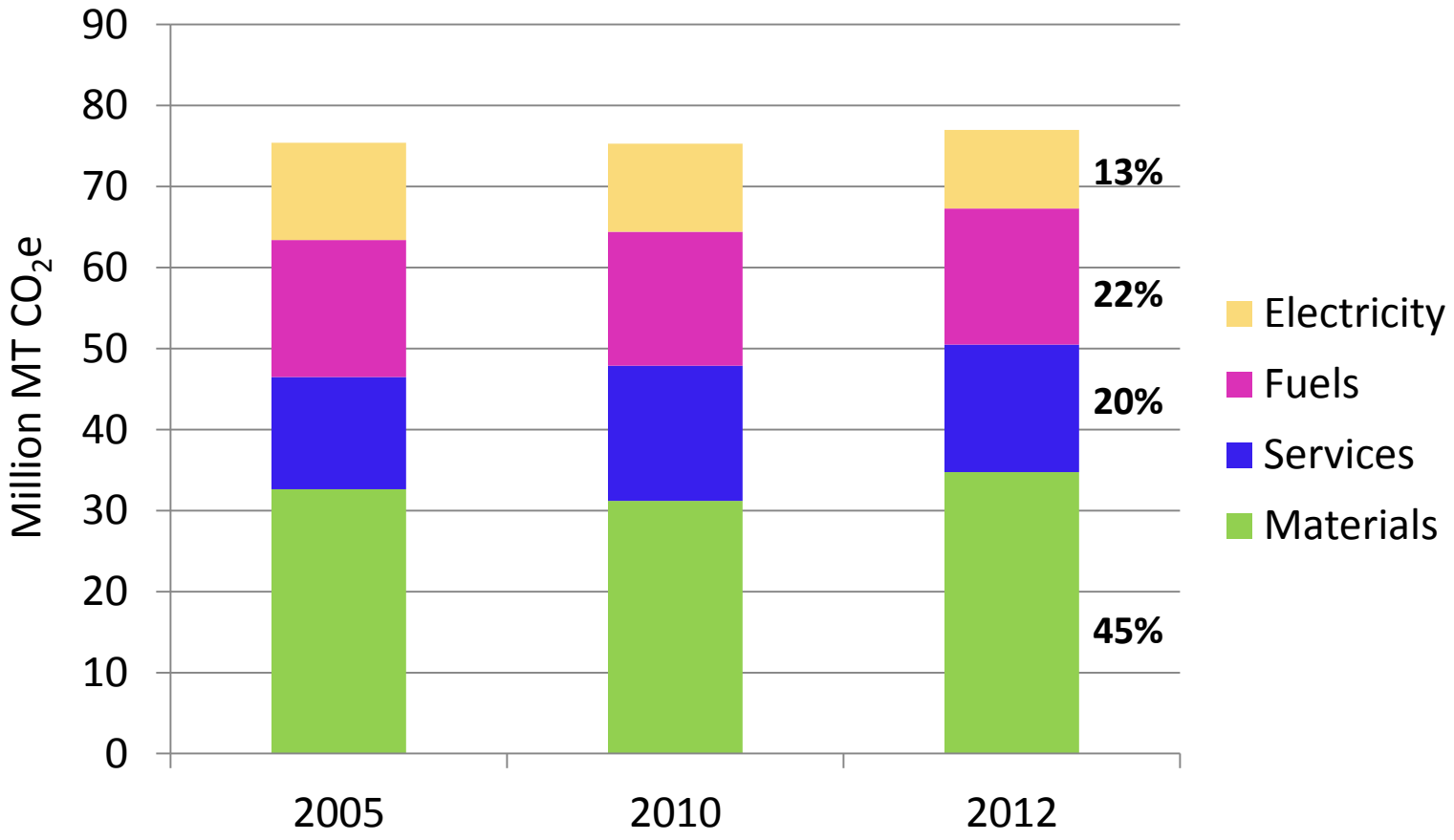

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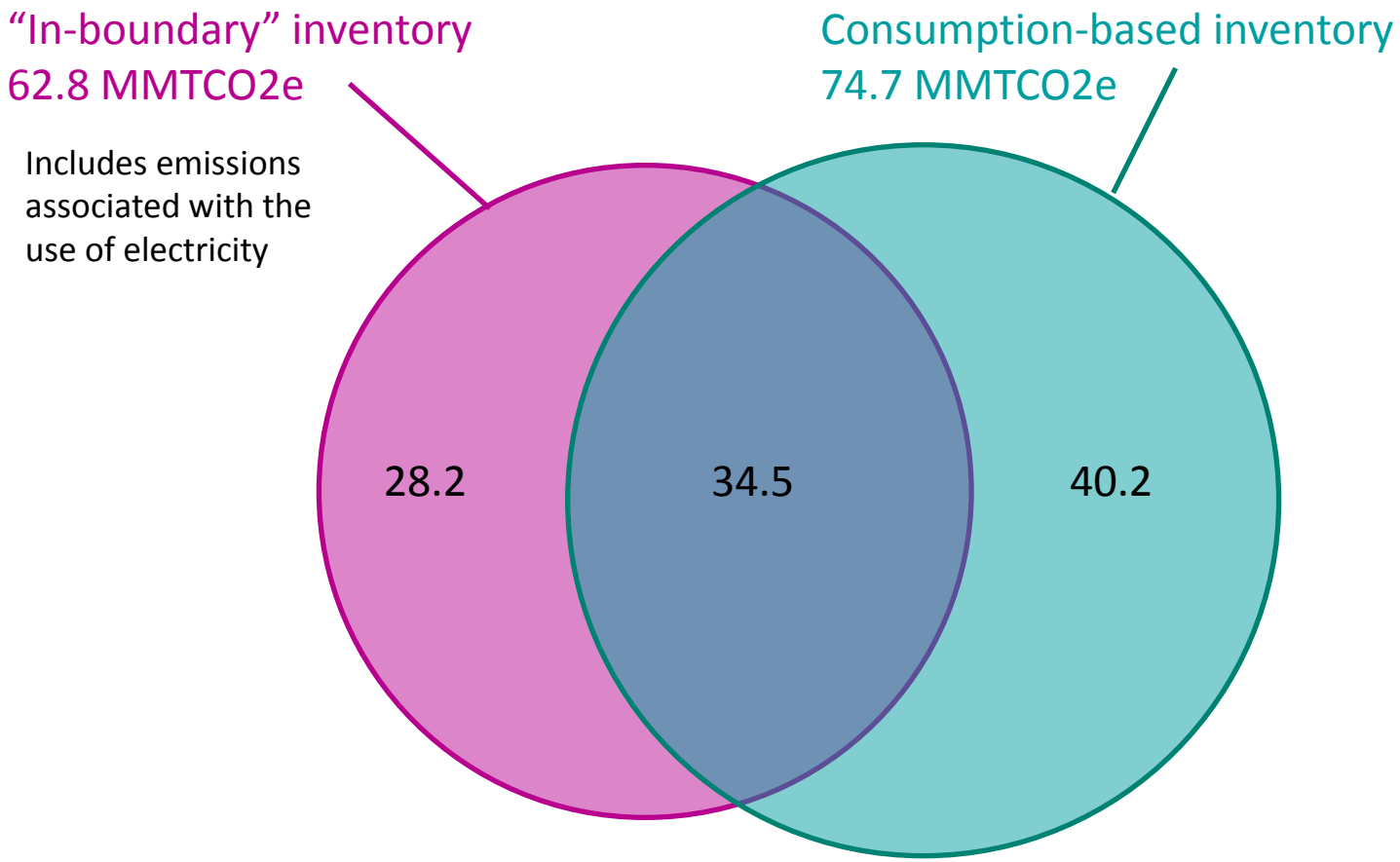
More emissions intensities

Categories	LCA Pre-purchase Emissions Intensities (kg CO2e/2010$)
Transportation services	1.6
Clothing	1.0
Food and beverages	0.8
Appliances	0.6
Construction	0.5
Furnishings and supplies	0.4
Electronics	0.3
Services	0.2

Oregon Emissions Inventories Compared (2010*)



Total 2010 Emissions: 102.9 MMTCO2e

*As published in 2013, before 2015 revisions

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Are emissions trending upward? Or downward?

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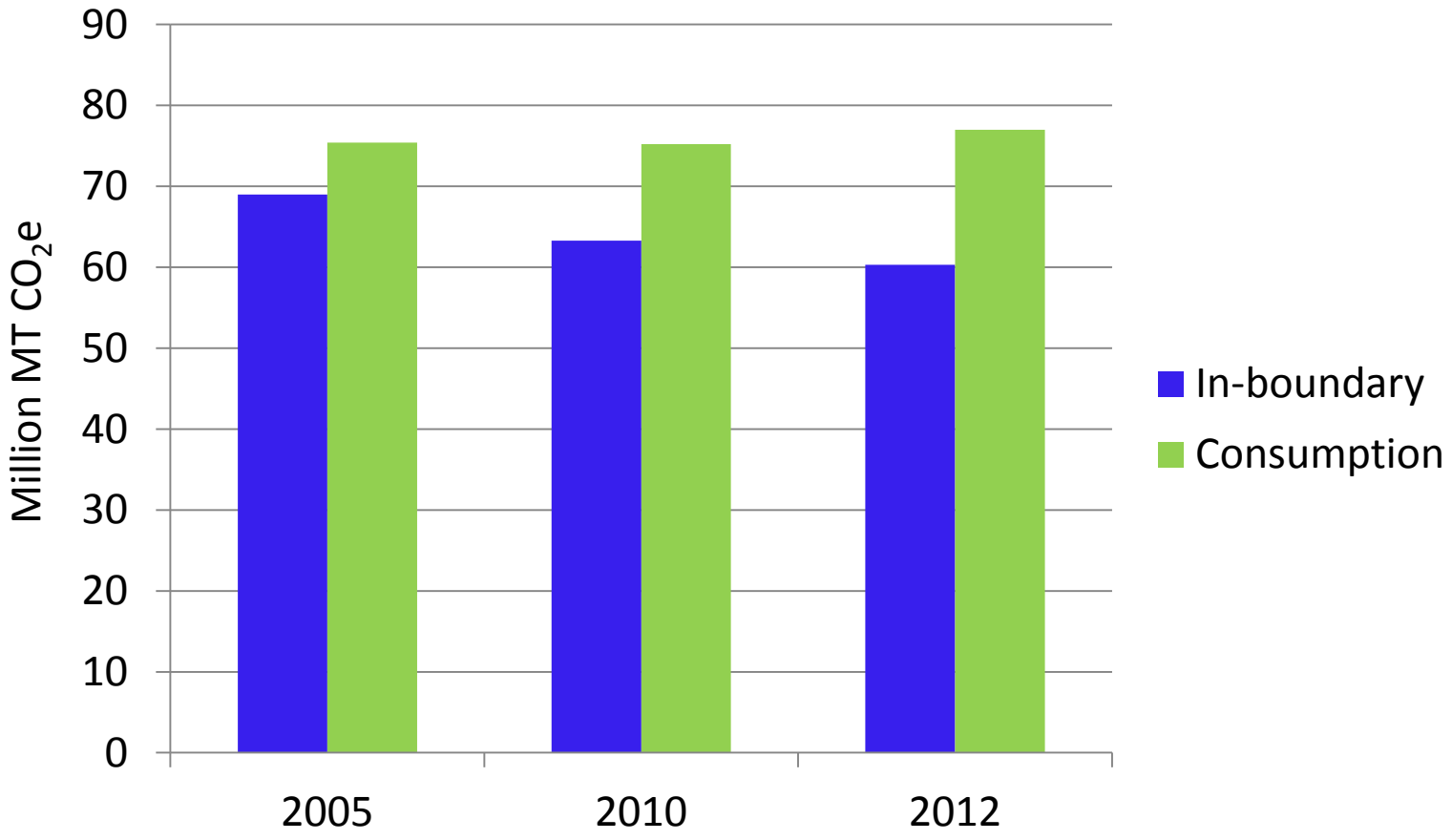
Oregon Greenhouse Gas Emissions



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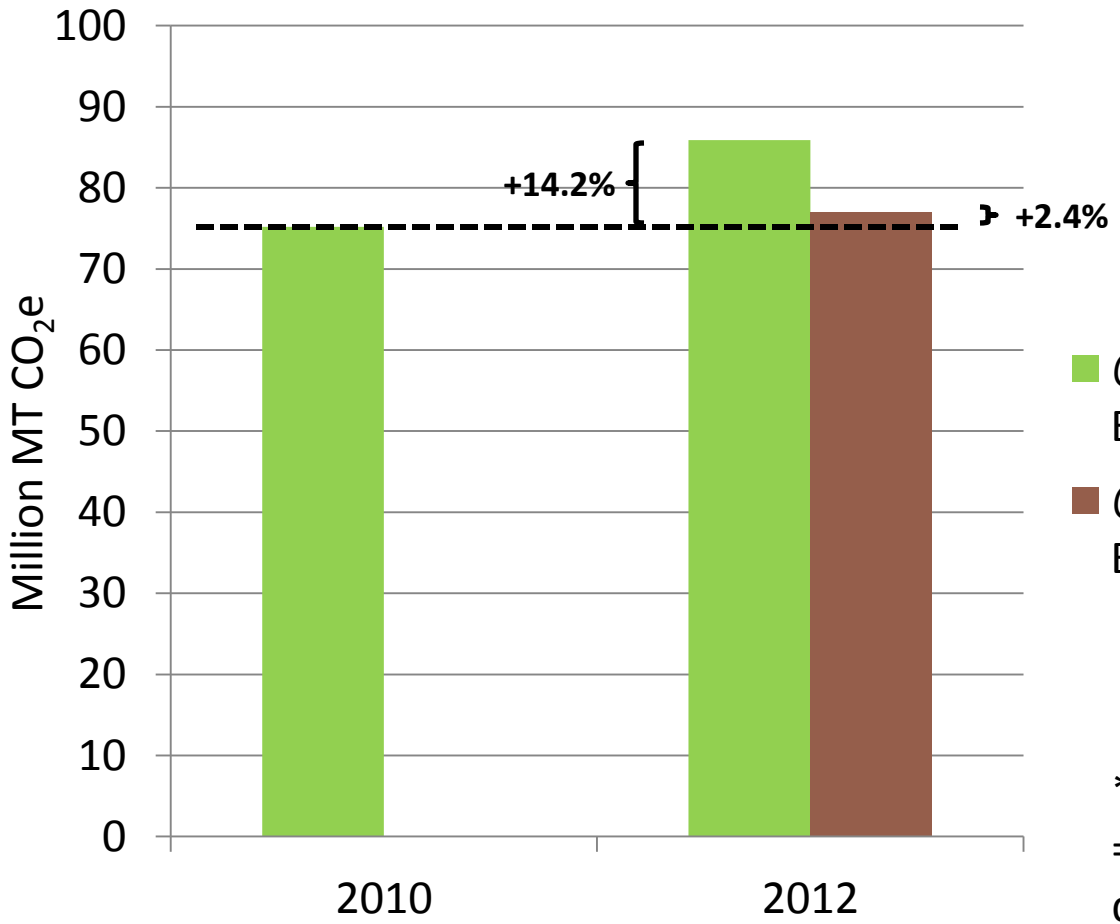
2010 vs. 2012 Oregon Consumption-Based Greenhouse Gas Emissions with 2010 vs. 2012 Upstream Emissions Intensities*



@ 2010 Upstream Emissions Intensities

@ 2012 Upstream Emissions Intensities

*Emissions intensity = GHG emissions per dollar of economic output

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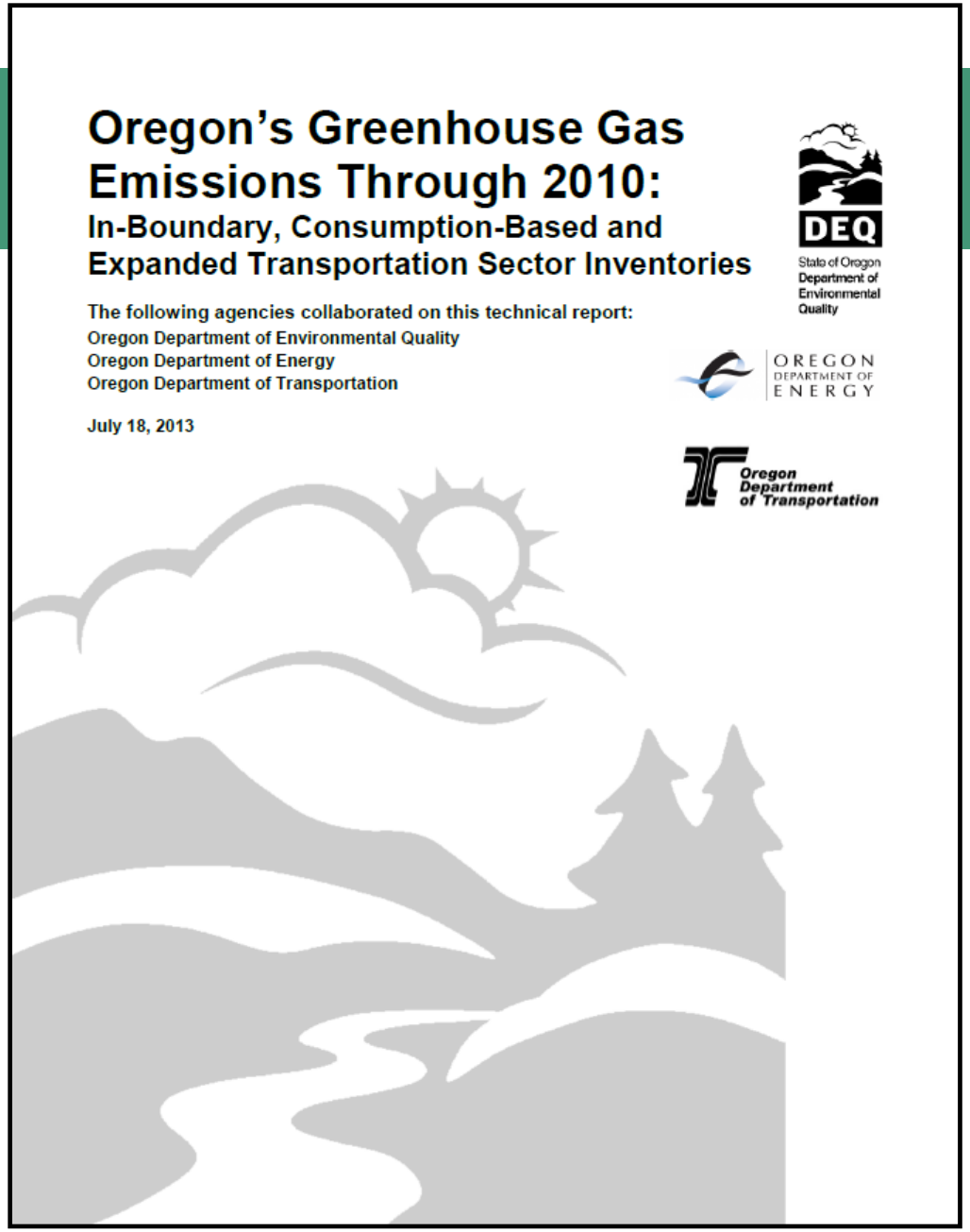
Potential uses of the consumption-based inventory

- ID “hot spots” (high emissions, high intensities)
  - Hot spots → potential focus areas
- Communication to consumers
- Research
- Enhance credibility of the larger inventory and climate action planning
- Inform design of programs
- Government purchashing
- Track change over time?

Key challenges of the consumption-based inventory

- Complex modeling requirements
- Consumption data is estimated, not actual
  - Oregon demographics (# of households in 9 income strata) x average US/regional per-household consumption baskets for each income strata
- Lack of granularity (440 commodity types)
  - The price-quality problem

Integration



Oregon's Greenhouse Gas Emissions Through 2010:

In-Boundary, Consumption-Based and Expanded Transportation Sector Inventories

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The following agencies collaborated on this technical report:
Oregon Department of Environmental Quality
Oregon Department of Energy
Oregon Department of Transportation

OREGON DEPARTMENT OF ENERGY

July 18, 2013

Oregon Department of Transportation

What next?

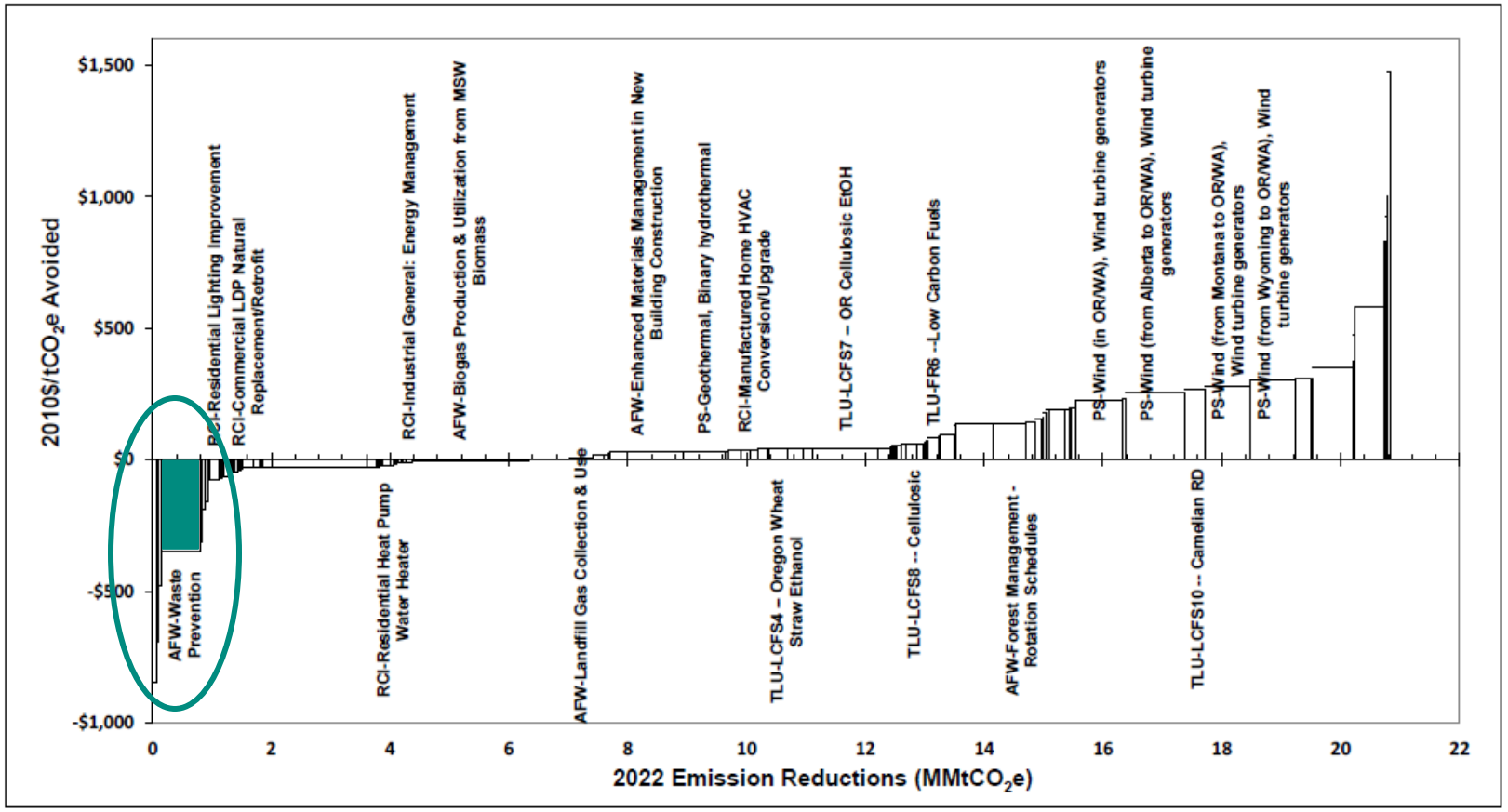
- Oregon's *2050 Vision for Materials Management*
- Built environment/green building
  - Whole building LCA (use phase + materials)
  - Programs to reduce environmental impact of materials
- Product environmental footprinting
  - Research into business benefits and barriers
  - Phase 2:
    - Environmental product declarations for concrete
    - "Hot spot" and best practices research for food
    - Case studies for businesses

What next? (continued)

- Government purchasing
  - West Coast Forum on Climate and Materials Management low-carbon purchasing toolkit
- USDN sustainable consumption toolkit
- Food waste prevention
- Strategic plan for product reuse, repair and lifespan extension
- Product stewardship (broader than extended producer responsibility)

Oregon marginal abatement cost curve analysis

Figure 2. Marginal Abatement Cost Curve for Scenario 1, Year 2022



Concluding thoughts

- Both inventories (in-boundary, consumption) offer unique perspectives on how states contribute to emissions . . .
  - . . . and opportunities to reduce them.
- Consumption-based inventories are not a substitute for in-boundary inventories . . . but do lead states (and others) to a wider range of options
- Greenhouse gases are a global pollutant – ignoring trans-boundary emissions tells an incomplete story of our shared responsibility
- Consumption is particularly important as the *root driver* of emissions
- Consumption-based inventories, policies and programs are (mostly) relatively young fields

Thank you

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